ClinicalEvidence

Spontaneous pneumothorax

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ABSTRACT

INTRODUCTION: The incidence of spontaneous pneumothorax is 24/100,000 a year in men and 9.9/100,000 in women in England and Wales. The major contributing factor is smoking, which increases the likelihood by 22 times in men, and by 8 times in women. While death from spontaneous pneumothorax is rare, rates of recurrence are high, with one study of men in the US finding a total recurrence rate of 35%. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical questions: What are the effects of treatments in people presenting with spontaneous pneumothorax? What are the effects of interventions to prevent recurrence in people with previous spontaneous pneumothorax? We searched: Medline, Embase, The Cochrane Library and other important databases up to April 2007 (BMJ Clinical Evidence reviews are updated periodically, please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 16 systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: chest-tube drainage (alone or plus suction), chest tubes (small, standard sizes, one-way valves), needle aspiration, and pleurodesis.

QUESTIONS

INTERVENTIONS

TREATMENTS FOR SPONTANEOUS PNEUMOTHORAX

Likely to be beneficial

Unknown effectiveness

PREVENTING RECURRENCE OF SPONTANEOUS PNEUMOTHORAX

Trade off between benefits and harms

Unknown effectiveness

To be covered in future updates

Aspiration catheter with integral one way valve system (Heimlich valve)

Key points

- Spontaneous pneumothorax is defined as air entering the pleural space without any provoking factor, such as trauma, surgery, or diagnostic intervention.

  Incidence is 24/100,000 a year in men, and 10/100,000 in women in England and Wales, and the major contributing factor is smoking, which increases the likelihood by 22 times in men and by 8 times in women.

  While death from spontaneous pneumothorax is rare, rates of recurrence are high, with one study of men in the US finding a total recurrence rate of 35%.

- Overall, we found insufficient evidence to determine whether any intervention is more effective than no intervention for spontaneous pneumothorax.

- Chest-tube drainage appears to be a useful treatment for spontaneous pneumothorax, although the evidence is somewhat sparse.

  Small (8 French gauge) chest tubes are generally easier to insert, and may reduce the risk of subcutaneous emphysema, although successful resolution may be less likely in people with large pneumothoraces (more than 50% lung volume). We don't know whether there is a difference in duration of drainage with small tubes.

  The trials investigating the efficacy of adding suction to chest-tube drainage are too small and underpowered to detect a clinically important difference.

  We don't know whether using one-way valves on a chest tube is more effective than using drainage bottles with underwater seals. There is a suggestion, however, that one-way valves might reduce hospital admission and the need for analgesia.

- It appears that needle aspiration might be beneficial in treating people with spontaneous pneumothorax, although it is not clear whether it is more effective than chest-tube drainage.
- Pleurodesis seems to be effective in preventing recurrent spontaneous pneumothorax, although there are some adverse effects associated with the intervention.

  Chemical pleurodesis successfully reduces recurrence of spontaneous pneumothorax, although the injection has been reported to be intensely painful.

  Thorascopic surgery with talc instillation also appears to reduce recurrence of spontaneous pneumothorax, but leads to a modest increase in pain during the first 3 days.

  There is no evidence examining when pleurodesis should be given, although there is general consensus that it is warranted after the second or third episode of spontaneous pneumothorax.

DEFINITION

A pneumothorax is air in the pleural space. A **spontaneous pneumothorax** occurs when there is no provoking factor — such as trauma, surgery, or diagnostic intervention. It implies a leak of air from the lung parenchyma through the visceral pleura into the pleural space, which causes the lung to collapse and results in pain and shortness of breath. This review does not include people with **tension pneumothorax**.

INCIDENCE/ PREVALENCE

In a survey in Minnesota, USA, the incidence of spontaneous pneumothorax was 7/100,000 for men and 1/100,000 for women. [1] In England and Wales, the overall rate of people consulting with pneumothorax (in both primary and secondary care combined) is 24/100,000 a year for men and 10/100,000 a year for women. [2] The overall annual incidence of emergency hospital admissions for pneumothorax in England and Wales is 16.7/100,000 for men and 5.8/100,000 for women. [2] Smoking increases the likelihood of spontaneous pneumothorax by 22 times for men and by 8 times for women. The incidence is directly related to the amount smoked. [3]

AETIOLOGY/ RISK FACTORS

Primary spontaneous pneumothorax is thought to result from congenital abnormality of the visceral pleura, and is typically seen in young, otherwise fit people. Secondary spontaneous pneumothorax is caused by underlying lung disease, typically affecting older people with emphysema or pulmonary fibrosis. [4]

PROGNOSIS

Death from spontaneous pneumothorax is rare, with UK mortality of 1.26 per million a year for men and 0.62 per million a year for women. [2] Published recurrence rates vary. One cohort study in Denmark found that, after a first episode of primary spontaneous pneumothorax, 23% of people suffered a recurrence within 5 years, most of them within 1 year. [5] Recurrence rates had been thought to increase substantially after the first recurrence, but one retrospective case-control study (147 US military personnel) found that 28% of men with a first primary spontaneous pneumothorax had a recurrence; 23% of the 28% had a second recurrence; and 14% of that 23% had a third recurrence, resulting in a total recurrence rate of 35%. [6]

AIMS OF INTERVENTION

To reduce morbidity; to restore normal function as quickly as possible; to prevent recurrence and mortality, with minimum adverse effects.

OUTCOMES

Successful resolution of spontaneous pneumothorax after a stated period; time to full expansion of the lung; duration of hospital stay; time off work; harmful effects of treatments (pain, surgical emphysema, wound, and pleural space infection); and rate of recurrence.

METHODS

BMJ Clinical Evidence search and appraisal April 2007. The following databases were used to identify studies for this systematic review: Medline 1966 to April 2007, Embase 1980 to April 2007, and The Cochrane Database of Systematic Reviews and Cochrane Central Register of Controlled Clinical Trials 2007, Issue 1. Additional searches were carried out using these websites: NHS Centre for Reviews and Dissemination (CRD) — for Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA), Turning Research into Practice (TRIP), and NICE. We also searched for retractions of studies included in this review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the author for additional assessment, using pre-determined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews and RCTs in any language, including open studies, and containing more than 20 individuals, of whom more than 80% were followed up. There was no minimum length of follow-up required to include studies. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the UK Medicines and Healthcare products Regulatory Agency (MHRA), which are added to the reviews as required. We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 10).

QUESTION **What are the effects of treatments in people presenting with spontaneous pneumothorax?**

OPTION **NEEDLE ASPIRATION**

Resolution rates
Compared with observation Needle aspiration may be more effective at increasing resolution rates (low-quality evidence).

Compared with chest-tube drainage We don't know whether needle aspiration is more effective at achieving success rates at 1 week in people with spontaneous pneumothorax (very low-quality evidence).

Duration of hospital stay
Compared with chest-tube drainage Needle aspiration is more effective at reducing the duration of hospital stay in people with spontaneous pneumothorax (moderate-quality evidence).

Recurrence rates
Compared with chest-tube drainage We don't know whether needle aspiration is more effective at preventing recurrence of spontaneous pneumothorax at 1 year (low-quality evidence).

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits:

Needle aspiration versus observation:
We found no systematic review. We found one small RCT (21 people), which found faster resolution with needle aspiration compared with observation (mean time to full expansion: 1.6 weeks in 8 people successfully treated with needle aspiration *v* 3.2 weeks in 10 people treated conservatively; significance assessment not performed). [7] However, two people randomised to needle aspiration required a chest tube.

Needle aspiration versus chest-tube drainage:
We found two systematic reviews. [8] [9] The first review (search date 2003, 3 RCTs, [10] [11] [12] 194 people with primary or recurrent spontaneous pneumothorax) [8] found that needle aspiration was associated with a significantly shorter hospital stay compared with chest-tube drainage (WMD –1.3 days, 95% CI –2.2 days to –0.39 days; P = 0.005). Rates of successful resolution could not be combined because of differences in outcome definitions. However, a pooled result of "success at 1 week or more" showed no significant difference between treatments (RR 0.86, 95% CI 0.67 to 1.11). There was also no significant difference between treatments in recurrence at 1 year (RR 0.73, 95% CI 0.39 to 1.38). [8] The second systematic review (search date 2006) [9] excluded two of the RCTs [10] [11] identified by the first review because it was unclear whether participants in these RCTs were experiencing a first episode of spontaneous pneumothorax. The review included one RCT (60 people) [12] and found similar results to the first review.

Harms:

Needle aspiration versus observation:
The RCT gave no information on adverse effects. [7]

Needle aspiration versus chest-tube drainage:
In the first review, pain and dyspnoea scores could not be combined by the review because of differences in outcome definitions. [8] The first RCT identified by the review found that people treated with needle aspiration had significantly less pain on daily pain scores during their hospital stay (score chart not described further, mean score: 0.7 with needle aspiration *v* 1.5 with chest tube; P less than 0.001). [10] The second RCT identified by the review found no significant difference in pain or dyspnoea between needle aspiration and chest-tube drainage (scored on a scale from 1 to 5, results presented graphically, reported as non-significant). [11] The third RCT identified by the review did not assess pain. [12] The second systematic review stated that the included RCT [12] reported no complications in the simple-aspiration group, but did not report on complications in the intercostal-tube-drainage group. [9] The RCT found that manual aspiration significantly reduced the proportion of people requiring hospitalisation after treatment compared with chest-tube drainage (60 people: 14/27 [52%] with manual aspiration *v* 33/33 [100%] with chest-tube drainage; RR 0.52, 95% CI 0.36 to 0.75). It found no significant difference between groups in mean duration of hospitalisation (3.41 days with manual aspiration *v* 4.50 days with chest-tube drainage; WMD −1.09, 95% CI −2.18 to 0.00). [9]

Comment:

Needle aspiration versus observation:
The RCT comparing needle aspiration versus observation was published as a letter. [7]

OPTION CHEST-TUBE DRAINAGE ALONE

Resolution rates
Compared with needle aspiration We don't know whether chest-tube drainage may be more effective at achieving success rates at 1 week in people with spontaneous pneumothorax (very low-quality evidence).

Compared with chest-tube drainage plus suction We don't know whether chest-tube drainage alone is more effective at increasing lung expansion at 10 days in people with primary or secondary spontaneous pneumothorax (very low-quality evidence).

Duration of hospital stay
Compared with needle aspiration We don't know whether chest-tube drainage is more effective at reducing the duration of hospital stay in people with spontaneous pneumothorax (moderate-quality evidence).

Recurrence rates
Compared with needle aspiration We don't know whether chest-tube drainage is more effective at preventing recurrence of spontaneous pneumothorax at 1 year (low-quality evidence).

Note
We found no clinically important results about chest-tube drainage compared with observation in people with spontaneous pneumothorax.

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits:

Chest-tube drainage versus observation:
We found no systematic review or RCTs.

Chest-tube drainage versus needle aspiration:
See benefits of needle aspiration, p 3 .

Chest-tube drainage versus chest-tube drainage plus suction:
See benefits of chest-tube drainage plus suction, p 5 .

Harms:

Chest-tube drainage versus observation:
We found no RCTs.

Chest-tube drainage versus needle aspiration:
See harms of needle aspiration, p 3 .

Chest-tube drainage versus chest-tube drainage plus suction:
See harms of chest-tube drainage plus suction, p 5 .

Comment: None.

OPTION SMALL- VERSUS STANDARD-SIZED CHEST TUBES FOR CHEST-TUBE DRAINAGE

Resolution rates
Small-sized chest tubes compared with standard-sized chest tubes Small-gauge tubes seem to be less effective at achieving successful resolution in people with large pneumothoraces (moderate-quality evidence).

Duration of drainage
Small-sized chest tubes compared with standard-sized chest tubes We don't know whether small-gauge catheters (8 French gauge) are more effective at decreasing the duration of drainage, but they are less likely to cause subcutaneous emphysema (very low-quality evidence).

Note
Small-gauge chest tubes are usually easier to insert.

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits:

Small- versus standard-sized chest tubes:
We found no systematic review. We found no RCTs, but found one small non-randomised trial (44 people), which compared small-gauge catheters (8 French gauge) versus standard-sized chest tubes. [13] It found no significant difference in duration of drainage between groups (5 days with small tubes *v* 6 days with standard chest tubes; reported as non-significant, no further data reported). In people with large pneumothoraces (more than 50% lung volume), successful resolution was

significantly less likely with small-gauge than with standard chest tubes (8/14 [57%] with small tubes *v* 12/12 [100%] with standard tubes; P less than 0.05).

Harms:

Small versus standard sized chest tubes:
The non-randomised trial found that small-gauge catheters significantly reduced the risk of subcutaneous emphysema compared with conventional chest tubes (0/21 [0%] with small tubes *v* 9/23 [39%] with standard tubes; P less than 0.05). [13]

Comment:

Clinical guide:
Small- versus standard-sized chest tubes:
Small-gauge chest tubes are usually easier to insert.

OPTION ONE-WAY VALVES ON CHEST TUBES

Resolution rates
Compared with drainage bottles One-way valves and drainage bottles with underwater seals seem to be equally effective at improving expansion or nearly-complete expansion of the lung at 48 hours in people with spontaneous pneumothorax and respiratory distress (moderate-quality evidence).

Need for analgesia
Compared with drainage bottles One-way valves are more effective at reducing the need of analgesia in people with spontaneous pneumothorax and respiratory distress (high-quality evidence).

Duration of hospital stay
Compared with drainage bottles One-way valves are more effective at reducing hospital admissions in people with spontaneous pneumothorax and respiratory distress (high-quality evidence).

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits:

We found no systematic review. We found one RCT (30 people with spontaneous pneumothorax and respiratory distress). [14] The RCT compared a chest tube (13 French gauge) connected to a one-way valve versus a chest tube (14 French gauge) connected to a drainage bottle with an underwater seal. It found no significant difference between groups in rate of resolution at 48 hours (complete or nearly-complete expansion: 15/17 [88%] with one-way valve *v* 11/13 [85%] with drainage bottle; RR 1.04, 95% CI 0.78 to 1.39). However, it found that one-way valves significantly reduced hospital admissions compared with drainage bottles (5/17 [29%] with one-way valve *v* 13/13 [100%] with drainage bottle; RR 0.29, 95% CI 0.14 to 0.61). [14] It also found that significantly fewer people treated with a one-way valve required analgesia (5/17 [29%] with one-way valve *v* 10/13 [77%] with drainage bottle; RR 0.38, 95% CI 0.17 to 0.85). [14]

Harms:

The RCT found no significant difference in rates of complications between one-way valves and drainage bottles with underwater seals (need for a second drain: 3/17 [18%] with one-way valve *v* 1/13 [8%] with drainage bottle; skin emphysema: 3/17 [18%] with one-way valve *v* 3/13 [23%] with drainage bottle; reported as non-significant, no further data reported). [14]

Comment:

None.

OPTION CHEST-TUBE DRAINAGE PLUS SUCTION

Resolution rates
Compared with chest-tube drainage alone Chest-tube drainage plus suction may be no more effective at increasing lung expansion at 10 days in people with primary or secondary spontaneous pneumothorax (very low-quality evidence).

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits:

Chest-tube drainage plus suction versus chest-tube drainage alone:
We found no systematic review, but found one RCT (53 people, 23 with primary and 30 with secondary spontaneous pneumothorax) [15] and one controlled clinical trial (40 people) [16] comparing chest-tube drainage using an underwater seal only versus drainage plus suction. The RCT found no significant difference between chest-tube drainage plus suction and chest-tube drainage alone in the proportion of people with full lung expansion at 10 days (13/23 [57%] with suction *v* 15/30 [50%] without suction; ARI +7%, 95% CI –21% to +34%; RR 1.13, 95% CI 0.68 to 1.88), but is likely to have been too small to detect a clinically important difference. [15] Suction pressures ranged from 8–20 cm H_2O. [15] The controlled clinical trial assigned people to chest-tube drainage plus suction or chest-tube drainage alone by alternate allocation. [16] It also found no significant difference in time taken for lung expansion between adding low-pressure suction to chest drainage and chest drainage alone (mean: 5.2 days with suction *v* 6.2 days with no suction; reported as non-significant,

CI not reported). The trial did not state whether spontaneous pneumothorax was primary or secondary, or what suction pressure was applied.

Harms: **Chest-tube drainage plus suction versus chest-tube drainage alone:**
The RCT [15] and controlled clinical trial [16] gave no information on adverse effects.

Comment: None.

QUESTION **What are the effects of interventions to prevent recurrence in people with previous spontaneous pneumothorax?**

OPTION **PLEURODESIS**

Recurrence
Adding chemical pleurodesis to chest-tube drainage compared with chest-tube drainage alone We don't know whether chemical pleurodesis using tetracycline or talcum powder is more effective at reducing recurrence rates at 30 months or 4.6 years in people with spontaneous pneumothorax (low-quality evidence).

Thoracoscopic surgery with talc instillation compared with chest-tube drainage Thoracoscopic surgery with talc instillation is more effective at reducing recurrence rates at 5 years in people with primary spontaneous pneumothorax (moderate-quality evidence).

Video-assisted thoracoscopic surgery versus thoracotomy We don't know whether video-assisted thoracoscopic surgery is more effective at reducing recurrence rates at 15 months or 3 years in people with primary or secondary spontaneous pneumothorax (low-quality evidence).

Need for analgesia
Video-assisted thoracoscopic surgery versus thoracotomy We don't know whether video-assisted thoracoscopic surgery may be more effective at reducing the need of analgesia in people with primary or secondary spontaneous pneumothorax (very low-quality evidence).

Duration of hospital stay
Chemical pleurodesis plus chest-tube drainage compared with chest-tube drainage alone Chemical pleurodesis plus chest-tube drainage may be no more effective at reducing the duration of hospital stay in people with spontaneous pneumothorax (low-quality evidence).

Thoracoscopic surgery with talc instillation compared with chest-tube drainage Thoracoscopic surgery with talc instillation may be no more effective at reducing the duration of hospital stay in people with spontaneous pneumothorax (low-quality evidence).

Video-assisted thoracoscopic surgery versus thoracotomy We don't know whether video-assisted thoracoscopic surgery may be more effective at reducing the duration of hospital stay in people with primary or secondary spontaneous pneumothorax (very low-quality evidence).

Note
Chemical pleurodesis injection (with tetracycline) is intensely painful. We found no clinically important results about chemical pleurodesis compared with surgical pleurodesis in people with spontaneous pneumothorax.

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits: **Adding chemical pleurodesis to chest-tube drainage versus chest-tube drainage alone:**
We found no systematic review. We found two RCTs. [17] [18] The first RCT (open label, 229 men with pneumothorax successfully treated by chest tube; mean age 54 years; 55% with COPD) found that adding intrapleural instillation of tetracycline significantly reduced recurrence rates over 30 months compared with chest tube alone (26/104 [25%] with tetracycline *v* 44/108 [41%] with chest tube alone; RR 0.61, 95% CI 0.41 to 0.92). [17] It found no significant difference between groups in length of hospital stay (5 days with tetracycline *v* 7 days with chest tube alone) or in 5-year mortality (40/113 [35%] with tetracycline *v* 42/116 [36%] with chest tube alone; RR 0.98, 95% CI 0.62 to 1.38). [17] The second RCT (96 people treated with chest-tube drainage) compared three groups: no further treatment, tetracycline pleurodesis, and talcum powder pleurodesis. [18] Mean follow-up was 4.6 years. It found that either type of chemical pleurodesis reduced the pneumothorax recurrence rate over 4.6 years compared with no treatment, although the difference did not reach significance with tetracycline pleurodesis (2/24 [8%] with talcum powder pleurodesis *v* 3/23 [13%] with tetracycline pleurodesis *v* 9/25 [36%] with no treatment; difference between talcum powder pleurodesis and no treatment reported as significant; difference between tetracycline pleurodesis and no treatment reported as not significant; significance assessment not performed). The RCT found no significant difference in mean hospital stay (7 days with tetracycline pleurodesis *v* 6 days

with talcum powder pleurodesis or with chest tube alone; reported as non-significant, significance assessment not performed). [18]

Thoracoscopic surgery with talc instillation versus chest-tube drainage:
We found no systematic review. We found one multicentre RCT (108 people with large primary spontaneous pneumothorax or primary spontaneous pneumothorax that had failed aspiration) that compared thoracoscopic surgery with talcum powder instillation versus chest-tube drainage. [19] It found that thoracoscopic surgery plus talcum powder instillation significantly reduced the recurrence rate at 5 years compared with chest-tube drainage (3/59 [5%] with surgery *v* 16/47 [34%] with chest-tube drainage; P less than 0.01). It found similar length of mean hospital stay (8.0 days with surgery *v* 7.4 days with chest-tube drainage; significance assessment not performed).

Video-assisted thoracoscopic surgery versus thoracotomy:
We found no systematic review. We found two RCTs. [20] [21] The first RCT (60 people with primary spontaneous pneumothorax, either first recurrence or non-resolving first episode) compared video-assisted thoracoscopic surgery versus thoracotomy. [20] It found no significant difference between video-assisted thoracoscopic surgery and thoracotomy in recurrence rates after 3 years (3/30 [10%] with video-assisted surgery *v* 0/30 [0%] with thoracotomy; ARR +10%, 95% CI –1% to +21%). However, it found that video-assisted surgery significantly reduced the use of analgesia and length of hospital stay compared with thoracotomy (mean hospital stay: 6.5 days with video-assisted surgery *v* 10.7 days with thoracotomy; P less than 0.0001). The second RCT (60 people, 30 with primary pneumothorax, 30 with secondary, either with recurrence or an air leak persisting for more than 5 days) compared video-assisted thoracoscopic surgery versus thoracotomy. [21] It found no significant difference in recurrence rate at 15 months (2/15 [13%] with video-assisted surgery *v* 1/15 [7%] with thoracotomy; reported as non-significant, significance assessment not performed). The RCT is likely to have been too small to detect a clinically important difference. It found no significant difference between video-assisted thoracoscopic surgery and thoracotomy in use of analgesia or length of hospital stay (mean hospital stay: 4 days with video-assisted surgery *v* 5 days with thoracotomy; reported as non-significant, significance assessment not reported).

Chemical versus surgical pleurodesis:
We found no systematic review or RCTs.

Harms:

Adding chemical pleurodesis to chest-tube drainage versus chest-tube drainage alone:
In the first RCT, 61/105 (58%) people reported intense chest pain on injection of tetracycline. [17] The second RCT found that similar proportions of people reported pain with either type of chemical pleurodesis compared with chest tube alone (17/33 [52%] with tetracycline pleurodesis *v* 14/29 [48%] with talcum powder pleurodesis *v* 18/34 [53%] with chest tube alone; significance assessment not performed). [18]

Thoracoscopic surgery with talc instillation versus chest-tube drainage:
The RCT did not establish a protocol for analgesia; four centres gave postoperative systemic opioids and three did not. [19] The RCT found that thoracoscopic surgery modestly but significantly increased pain during the first 3 days compared with chest-tube drainage (results presented graphically). It found no significant difference in pain between groups when people received systemic opioids.

Video-assisted thoracoscopic surgery versus thoracotomy:
The first RCT gave no information on adverse effects. [20] The second RCT reported that three people with secondary spontaneous pneumothorax died, one receiving video-assisted thoracoscopic surgery and two receiving thoracotomy, one of whom had previously had unsuccessful video-assisted thoracoscopic surgery. [21]

Chemical versus surgical pleurodesis:
We found no RCTs.

Comment:

None.

OPTION OPTIMAL TIMING OF PLEURODESIS (AFTER FIRST, SECOND, OR SUBSEQUENT EPISODES)

We found no direct information about whether pleurodesis should take place after the first, second, or subsequent episodes of spontaneous pneumothorax.

For GRADE evaluation of interventions for spontaneous pneumothorax, see table, p 10 .

Benefits:

Optimal timing of pleurodesis:
We found no systematic review. We found no RCTs or high-quality cohort studies comparing pleurodesis undertaken at different times (after the first, second, or subsequent episodes of spontaneous pneumothorax; see comment below).

Harms:

Optimal timing of pleurodesis:
We found no RCTs or high-quality cohort studies.

Comment:

Clinical guide:
One observational study suggested that the 5-year recurrence rate after a first pneumothorax is about 28%, so there may be little reason to perform pleurodesis after the first episode of pneumothorax. [6] There has been consensus that pleurodesis is warranted after the second or third episode of pneumothorax. Even though the probability of success with pleurodesis is high, clinicians will have to weigh the likelihood of recurrence against the morbidity associated with the procedure. Chemical pleurodesis may be appropriate for people unfit or unwilling to have surgery.

GLOSSARY

French gauge A measure of the size of a catheter or drainage tube defined (in France by JFB Charrière in 1842) to be the outside diameter of the tube in units of 1/3 mm. A 12 French gauge tube has an outer diameter of 4 mm. Sometimes the French gauge is called the Charrière (Ch) gauge.
High-quality evidence Further research is very unlikely to change our confidence in the estimate of effect
Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Needle aspiration One systematic review added, comparing manual aspiration versus chest-tube drainage in people with first episode of spontaneous pneumothorax; [9] categorisation unchanged (Likely to be beneficial).

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TABLE **GRADE evaluation of interventions for spontaneous pneumothorax**

Important outcomes	Symptom resolution rates, recurrence, duration of hospital stay, need for further interventions, adverse effects								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of treatments in people presenting with spontaneous pneumothorax?									
1 (18) [7]	Resolution rates	Needle aspiration *v* observation	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
3 (194) [10] [11] [12]	Duration of hospital stay	Needle aspiration *v* chest-tube drainage	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
3 (194) [10] [11] [12]	Resolution rates	Needle aspiration *v* chest-tube drainage	4	−2	0	−1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for differences in definition of outcome
3 (194) [10] [11] [12]	Recurrence	Needle aspiration *v* chest-tube drainage	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
1 (44) [13]	Duration of drainage	Small- *v* standard-sized chest tubes	4	−3	0	0	0	Very low	Quality points deducted for sparse data, incomplete reporting of results, and non-randomised trial
1 (26) [13]	Resolution rates	Small- *v* standard-sized chest tubes	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
1 (30) [14]	Resolution rates	One-way valve *v* drainage bottles	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
1 (30) [14]	Need for analgesia	One-way valve *v* drainage bottles	4	−1	0	0	+1	High	Quality point deducted for sparse data. Effect-size point added for RR less than 0.5
1 (30) [14]	Duration of hospital stay	One-way valve *v* drainage bottles	4	−1	0	0	+1	High	Quality point deducted for sparse data. Effect size point added for RR less than 0.5
1 RCT and one trial (97) [15] [16]	Resolution rates	Chest-tube drainage plus suction *v* chest-tube drainage alone	4	−3	0	−2	0	Very low	Quality points deducted for sparse data, incomplete reporting of results, and inclusion of CCT. Directness points deducted for not stating suction pressures used, and not stating whether primary or secondary spontaneous pneumothorax
What are the effects of interventions to prevent recurrence in people with previous spontaneous pneumothorax?									
2 (325) [17] [18]	Recurrence rates	Adding chemical pleurodesis to chest-tube drainage *v* chest-tube drainage alone	4	−2	0	0	0	Low	Quality points deducted for incomplete reporting of results, and for open-label RCT
2 (325) [17] [18]	Duration of hospital stay	Adding chemical pleurodesis to chest-tube drainage *v* chest-tube drainage alone	4	−2	0	0	0	Low	Quality points deducted for incomplete reporting of results, and for open-label RCT
1 (108) [19]	Recurrence rates	Thoracoscopic surgery with talc instillation *v* chest-tube drainage	4	−1	0	0	0	Moderate	Quality point deducted for sparse data
1 (108) [19]	Duration of hospital stay	Thoracoscopic surgery with talc instillation *v* chest-tube drainage	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results

Important outcomes	Symptom resolution rates, recurrence, duration of hospital stay, need for further interventions, adverse effects								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
2 (120) [20] [21]	Recurrence rates	Video-assisted thoracoscopic surgery *v* thoracotomy	4	−2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
2 (120) [20] [21]	Need for analgesia	Video-assisted thoracoscopic surgery *v* thoracotomy	4	−2	−1	0	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Consistency point deducted for conflicting results
2 (120) [20] [21]	Duration of hospital stay	Video-assisted thoracoscopic surgery *v* thoracotomy	4	−2	−1	0	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Consistency point deducted for conflicting results

Type of evidence: 4 = RCT; 2 = Observational; 1 = Non-analytical/expert opinion. Consistency: similarity of results across studies
Directness: generalisability of population or outcomes
Effect size: based on relative risk or odds ratio